



(12) **EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
**07.04.1999 Bulletin 1999/14**

(51) Int. Cl.<sup>6</sup>: **F25B 9/00, F25B 41/06**

(43) Date of publication A2:  
**30.07.1997 Bulletin 1997/31**

(21) Application number: **97101045.9**

(22) Date of filing: **23.01.1997**

(84) Designated Contracting States:  
**DE FR GB**

(30) Priority: **25.01.1996 JP 11248/96**  
**21.02.1996 JP 33962/96**

(71) Applicants:  
• **DENSO CORPORATION**  
**Kariya-City Aichi-Pref. 448 (JP)**  
• **NIPPON SOKEN, INC.**  
**Nishio-shi Aichi-Ken (JP)**

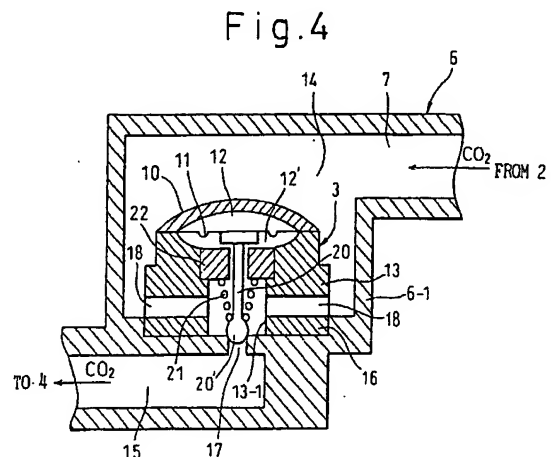
(72) Inventors:  
• **Sakakibara, Hisayoshi**  
**Kariya-city, Aichi-pref 448 (JP)**

• **Nishida, Shin**  
**Kariya-city, Aichi-pref 448 (JP)**  
• **Onimaru, Sadahisa**  
**Shimohasumi-cho, Nishio-shi, Aichi (JP)**  
• **Sakajo, Yuichi**  
**Shimohasumi-cho, Nishio-shi, Aichi (JP)**  
• **Ozaki, Yukikatsu**  
**Shimohasumi-cho, Nishio-shi, Aichi (JP)**

(74) Representative:  
**Klingseisen, Franz, Dipl.-Ing.**  
**Patentanwälte,**  
**Dr. F. Zumstein,**  
**Dipl.-Ing. F. Klingseisen,**  
**Postfach 10 15 61**  
**80089 München (DE)**

(54) **Refrigerating system with pressure control valve**

(57) A refrigerating system of vapor compression type operating at a super critical area, while obtaining an increased efficiency. The refrigerating system includes a pressure control means (3) for controlling the temperature and the pressure at the outlet of a heat emitter (2). The pressure control valve (3) responds to a pressure difference between the inlet pressure of the refrigerant to the pressure control valve and the pressure in an outwardly sealed chamber (12) in which the refrigerant is filled such that, with respect to the volume of the chamber (12) under closed condition of the pressure control valve, a density of the refrigerant is in a range between a density of a saturated liquid at a temperature of 0°C and a density at the critical point of the refrigerant. As a result, the pressure and the temperature at the outlet of the heat emitter (2) is controlled substantially along the optimum control line  $\eta_{max}$ , resulting in an effective execution of a refrigerating cycle at the critical area.



EP 0 786 632 A3



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 97 10 1045

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
E	EP 0 837 291 A (DENSO CORP ; NIPPON SOKEN (JP)) 22 April 1998 * column 8, line 34 - column 13, line 8; figures 1-3 * * column 20, line 49 - column 23, line 58; figures 14-16 * * column 26, line 5 - column 29, line 47; figures 18,19 *	1-3,6-8, 11,12	F25B9/00 F25B41/06
X	NAKASHIMA Y., LIJIMA H., UMEHARA M., MATSUOKA F.: "Reversible-flow-type linear expansion valves for heat pumps" ASHRAE TRANS. (US), vol. 91 (part 2b), 1985, pages 1555-1568, XP002092713 * page 1556, paragraph 2 - paragraph 5; figures 1-3 *	7-10,12, 14	
X	EP 0 279 622 A (SANDEN CORP) 24 August 1988	7	
A	* column 2, line 25 - column 3, line 28; figures 3,4 *	1,4,6	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
X	EP 0 171 240 A (ALSENZ RICHARD H) 12 February 1986	7	F25B
A	* page 9, line 15 - page 12, line 28; figure 1 *	8,14	
A	DE 24 59 485 A (DANFOSS AS) 1 July 1976 * page 4, paragraph 3 - page 5, paragraph 3; figures *	1,3,6,7	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 9 February 1999	Examiner Van Dooren, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 97 10 1045

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-02-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0837291 A	22-04-1998	JP 10089785 A	10-04-1998
		JP 10115470 A	06-05-1998
		JP 10288411 A	27-10-1998
EP 0279622 A	24-08-1988	KR 9612738 B	24-09-1996
		US 4788828 A	06-12-1988
EP 0171240 A	12-02-1986	US 4651535 A	24-03-1987
		AU 4558485 A	13-02-1986
		CA 1272887 A	21-08-1990
		DE 3587300 A	03-06-1993
		DE 3587300 T	11-11-1993
		JP 61046868 A	07-03-1986
		US 5402652 A	04-04-1995
		US 5392612 A	28-02-1995
		US 4697431 A	06-10-1987
		US 5035119 A	30-07-1991
		US 4735060 A	05-04-1988
		US 4686835 A	18-08-1987
DE 2459485 A	01-07-1976	DK 570275 A,B,	17-06-1976
		GB 1534700 A	06-12-1978
		JP 51086852 A	29-07-1976
		US 4158437 A	19-06-1979

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

